# Broom Rusts

IDAHO DEPARTMENT OF LANDS

State Forester Forum

Broom rusts are fungus-caused diseases which result in the formation of witches' brooms on tree branches. Witches' brooms (Figures 1 & 2) are a generic term for any abnormally bushy, localized growth of a branch characterized by a proliferation of twigs with short internodes. Two broom rusts occur in Idaho; spruce broom rust, caused by *Chrysomyxa arctostaphyli*, and fir broom rust, caused by *Melampsorella caryophyllacearum*. They are distributed throughout Idaho but only cause damage to their hosts in a few localities; fir broom rust is very prevalent in the mountains of south eastern Idaho.

## Biology

Rust fungi have variously complex life cycles; the most complex produce five spore types and alternate infection among two non-related hosts. Other rusts have much simpler life cycles, producing only two or three spore types and infecting just one host to complete their life cycle. The non-commercial hosts of rust fungi are generally referred to as the "alternate" or "secondary" hosts, while the commercially-valuable hosts are referred to as the "primary" hosts. Each is equally necessary, however, for a rust to complete its life cycle.

*Chrysomyxa arctostaphyli*, cause of spruce broom rust, has a life cycle that produces four spore types and infects two plants, Engelmann spruce and kinnikinnick. Kinnikinnick is a small, broadleaved, evergreen forest plant. Infection of the conifer host causes formation of a witches' broom; infection of kinnikinnick causes purple-brown leaf spots. The fungus is systemic and perennial in spruce, meaning that once an infection is established the fungus remains alive in twigs which form the broom. Infection of kinnikinnick, on the other hand, needs to take place anew every year, so rust is found on these hosts only where they occur together.

*Melampsorella caryophyllacearum*, cause of fir broom rust, has a two-year life cycle that produces five spore types and infects *Abies* species and chickweeds. Chickweeds are small, broadleaved, herbaceous plants common in mountain environments. Infection of *Abies* spp. causes a witches' broom; infection of chickweed causes a leaf- or shoot-blight. Infection on both *Abies* spp. and certain chickweeds is systemic and perennial. Therefore chickweed species that are perennial do not have to be infected anew each year and can be found infected by rust far outside the range of fir. Rust is found on fir, however, only where it occurs with chickweeds.

## Hosts

**Spruce broom rust**

Conifer host: Engelmann spruce

Alternate host: Kinnikinnick (*Arctostaphylos uva-ursi*)

**Fir broom rust**

Conifer host: Grand fir, subalpine fir, and white fir.

Alternate host: Chickweeds (*Stellaria* & *Cerastium* spp.).

***Winston Wiggins***
***Director and State Forester***
***Idaho Department of Lands***
***954 W. Jefferson***
***Boise, ID 83720***
***Phone: (208) 334-0200***

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***Craig Foss***
***Chief, Bureau of Forestry Assistance***
***3780 Industrial Ave. S.***
***Coeur d'Alene, ID 83815***
***Phone: (208) 769-1525***

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## ***Recognition***

Shoots forming witches' brooms grow upright and produce needles with yellow to light-green coloration, making brooms stand out in the spring and summer against a background of normal, dark green foliage (Figures 1 & 2).

Figure 1: Witches' brooms in crown

The needles on a broom are shed in the fall, leaving it bare and for all appearances dead during winter. However, the broom remains alive and in early spring new needles grow from the infected shoots. These needles are shorter and thicker than needles on normal branches. In early summer bright-yellow or light-orange, tongue-like structures protrude from the needles of a rust broom (Figure 3).

These structures produce airborne spores that cause infection on the alternate hosts.

The infected branches of fir may have large, spindle-shaped or round swellings, while infected branches of spruce are seldom swollen.


Figure 2: Characteristic witches' broom due to rust infection

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Witches' brooms can be caused by other diseases as well, most notably dwarf mistletoes on various conifer species and Elytroderma needle cast on ponderosa pine. However, by identifying the host on which the broom is growing and examining the broom for the characteristics associated with broom rust, the disease can be readily diagnosed.

Figure 3: Fungus fruiting on infected needles

## ***Management***

Trees with the most severe infections, based on the number of brooms and their proximity to the stem, can be selectively removed during commercial harvest. Trees with rust brooms close to the main trunk should be given higher priority for removal due to potential for associated stem decay and defect.

Large witches' brooms can be pruned from high-value trees in recreation sites and around homes. This will prolong the life of infected trees and decrease potential hazard from falling brooms, but trees with brooms close to the stem may have developed stem decay or defect that pose their own risks.

**Required acknowledgements**:

Photo credits: "Forestry Images" - (http://www.forestryimages.org/)

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